Version with Markings to Show Changes Made

IN THE SPECIFICATION

The paragraph beginning on page 4, line 9 is amended as follows.

Fig. 1 is a top view of a lead frame [package] for use in forming internal leads.

The paragraph beginning on page 4, line 11 is amended as follows.

Fig. 2 shows a lead frame [package] with internal leads formed from the lead frame [package] of Fig. 1.

The paragraph beginning on page 4, line 23 is amended as follows.

Figs. 7A and 7B are top views of a partial lead frame [package], according to another embodiment of the present invention, in which the external and internal leads are interleaved.

The paragraph beginning on page 4, line 27 is amended as follows.

Fig. 8 is a side view of a portion of a die package utilizing the lead frame [package] of Fig. 7B.

The paragraph beginning on page 5, line 20 is amended as follows.

Fig. 1 is a top view of an ILT lead frame [package] 10 having a plurality of first external lead fingers or outer lead traces (OLTs) 12 and an internal paddle area 14 containing slots 16 and traces 17, where traces 17 are electrically connected. Lead frame [package] 10 is shown having slots 16 ending at three sides of the package. However, the lead frame [package]can be any suitable type, such as for a dual-sided or quad [packages] package.

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The paragraph beginning on page 6, line 13 is amended as follows.

Fig. 2 shows lead frame [package] 10 after removal of the outer portions of paddle area 14. Traces 17 are no longer electrically connected to other traces. Instead, each resulting inner lead trace 20 is electrically isolated from other ILTs 20. As shown in Fig. 2, ILTs 20 can carry signals to and from adjacent sides or to and from opposite sides of paddle area 14. It should be noted that the lead frame [package] shown in Fig. 2 can be modified so that ILTs 20 can carry signals to and from the perimeter and the interior of paddle area 14 for die with center bond pads. To achieve this, an interior portion of paddle area 14 is removed, such that ILTs 20 have ends at the perimeter and interior of paddle area 14. This is in contrast to lead frame [package] 10 of Fig. 2, in which ILTs 20 have ends only at the perimeter of the paddle area.

The paragraph beginning on page 6, line 29 is amended as follows.

A die can then be attached to lead frame [package] 10 of Fig. 2. Fig. 3A is a side view of a lead frame package 10-1 with a die 30, according to one embodiment. Die 30 is secured to ILTs 20 using a non-conductive film or die attach paste 32, with an inner lead trace (ILT) tape 33, such as a standard lead locking tape discussed above, placed on the bottom of ILT 20. Note that die 30 may also be secured to ILT tape 33 by film or paste 32 when tape 33 is placed on top of ILTs 20 (see Fig. 3B). The ends of ILTs 20 are down set or bent, such that the ends will be exposed after die 10 has been encapsulated or packaged, such as with a conventional encapsulant or mold compound 34. The position of ILTs 20 can be on approximately the same plane as the external lead bond fingers, the die attach pad, or somewhere in between. The ends of ILTs 20 are down set during the manufacture of the lead frame, prior to the die assembly process. Bond pads 36 of die 30 and selected ones of ILTs 20 and OLTs 12 are wire-bonded, such as with thin conductive bond wires 35, to provide the

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desired signal routing or interconnections between the die and the ILTs and OLTs. The package can then be encased, such as with encapsulant or mold compound 34. Portions of OLTs 12 and ILTs 20 are then attached to a printed circuit board (PCB) 37, such as with solder 38, to provide electrical connection between PCB 37 and die 30, via OLTs 12 and ILTs 20. Consequently, an increased number of inputs and outputs are possible to and from die 30.

The paragraph beginning on page 7, line 26 is amended as follows.

Fig. 3B is a side view of another embodiment of a lead frame package 10-2 with die 30. As noted above, die 30 is secured to ILT tape 33 by non-conductive film or paste 32 when tape 33 is placed on top of ILTs 20. In this embodiment, interior portions of ILTs 20 are also exposed through encapsulant 34, such as through an ILT pad 39. Die 30 can then be electrically connected to PCB 37 through OLTs 12, ILTs 20, and ILT pad 39 and solder 38. The additional connection using ILT pad 39 helps solve high frequency applications by creating low inductance signal paths through the bottom exposed ILT leads, with the exposed pad handling increased thermal needs due to the high frequency.

The paragraph beginning on page 8, line 7 is amended as follows.

Fig. 4 is a top view showing one configuration and pattern of OLTs 12 and ILTs 20 electrically connected to die 30 in a lead frame package 10-3. Note that only the outline of die 30 is shown to illustrate the underlying ILTs 20.

The paragraph beginning on page 8,ine 11 amended as follows.

In another embodiment, ILTs 20 can be down set or bent away from OLTs 12, as shown in lead frame package 10-4 of Fig. 5. In this embodiment, ILTs 20 are exposed on the upper surface of the die package. As shown in Fig. 6, this allows a second die package 60 to

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be stacked and electrically connected to die 30. External leads or fingers 62 from second die package 60 can be attached to ILTs 20 with a conductive material, such as solder 64. Connections from both die 30 and a die 66 of second die package 60 to PCB 37 are available through OLTs 12 and solder 38. As a result, multiple die and packages can be stacked and connected, and with thin package design, having a lower profile that conventional packages. Further, individual die in each package can first be tested before the die and package are stacked and connected to another die. If the die is bad or non-functioning, it is not connected to good die, thereby preventing bad die from consuming good die. Consequently, yield is increased over conventional single packages with stacked multiple die.

The paragraph beginning on page 8, line 31 is amended as follows.

Other embodiments of the present invention utilize ILTs and OLTs that are interleaved. This is in contrast to the above embodiments, in which the ends of the ILTs and OLTs do not overlap, i.e., not interleaved. Fig. 7A shows a portion of a partially-complete lead frame 11 [package] having external leads 70 and internal leads 72. Internal leads 72 are exposed above dotted line 74, underneath which indicates the ILT tape. As seen from Fig. 7A, external leads 70 and internal leads 72 are electrically connected at portions 76 prior to trimming according to allow conventional lead frame manufacturing process. Fig. 7B shows the portion of the lead frame 11 of Fig. 7A after trimming away portions 76, where the dotted line 78 indicates the trim area. As a result, interleaved external leads 70 and internal leads 72 are electrically isolated. The ends of internal leads 72 extend beyond the ends of external leads 70, which are now closer to the die. This allows the use of shorter bonding wires between external leads 70 and the die and enables exposed ILT pads to accommodate larger package outlines for stacking on top.

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The paragraph beginning on page 9, line 21 is amended as follows.

A die can then be attached to the lead frame 11 of Fig. 7B. The die can be attached, such as described above with respect to Fig. 3 or using any other suitable processes. Fig. 8 is a side view of a portion of die 30 attached to the lead frame 11 of a package 10-5. Die 30 is affixed to the lead frame with die attach paste 32. ILT tape 33 is placed on the bottom of the internal leads 70. The ends of internal leads 70 are down set or bent, such that the ends will be exposed after die 30 has been encapsulated or packaged. The position of the ends of internal leads 70 can be on approximately the same plane as the ends of external leads 72, the die attach pad, or somewhere in between. Wire bonding then provides electrical connection between die 30 and internal leads 70 and external leads 72, such as with bond wires 35 attached to bond pads 36. Note that the bond wires connected to external leads 72 in this embodiment are shorter than with the embodiment of Fig. 3. The package 10-5 can then be encased, such as with encapsulant or mold compound 34. Thus, similar to Fig. 3, this embodiment provides additional input/output connections to die 30.

The paragraph beginning on page 10, line 11 is amended as follows.

Fig. 9 is a top view showing one embodiment of a lead frame package 10-6 the invention, in which external leads 72 and internal leads 70 are interleaved. Note that bond wires 35 connected to external leads 72 are shorter here than the corresponding bond wires 35 of Fig. 4.

The paragraph beginning on page 10, line 16 is amended as follows.

In another embodiment, Fig. 10 is a side view of a portion of a lead frame [die] package 10-7, in which internal leads 70 have been down set or bent away from external leads 72, similar to Fig. 5 above. Internal leads 70 are exposed on the upper surface of the die

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package, thereby allowing a second die package to be electrically connected thereto, similar to Fig. 6 above. Again, the difference with this embodiment is shorter bond wires between the die and the external leads and a larger package outline for stacking on top can be accommodated.

IN THE CLAIMS

2. (Amended) The package of Claim 1, wherein the [first] second ends of the outer leads do not extend beyond the first ends of the inner leads.

3. (Amended) The package of Claim 1, wherein the [first] second ends of the outer leads extend beyond the first ends of the inner leads.

39. (Amended) A semiconductor die package, comprising:

a lead frame having external leads;

internal leads electrically isolated from the external leads and secured to the lead frame;

means for securing and electrically isolating the internal leads from each other;

a die electrically coupled to the external leads and the internal leads; and

means for encapsulating the die and portions of the internal and external leads,

wherein [the ends] a first end of at least some of the internal leads [are] is exposed through a surface of the means for encapsulating.

41. The package of Claim 40, wherein the first ends of the internal leads are exposed through a bottom surface of the means for encapsulating.

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42. The package of Claim 40, wherein the first ends of the internal leads are exposed through a top surface of the means for encapsulating.

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